

Turbulent-Spot Growth Characteristics : Wind-Tunnel and Flight Measurements of Natural Transition at High Reynolds and Mach Numbers

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Abstract

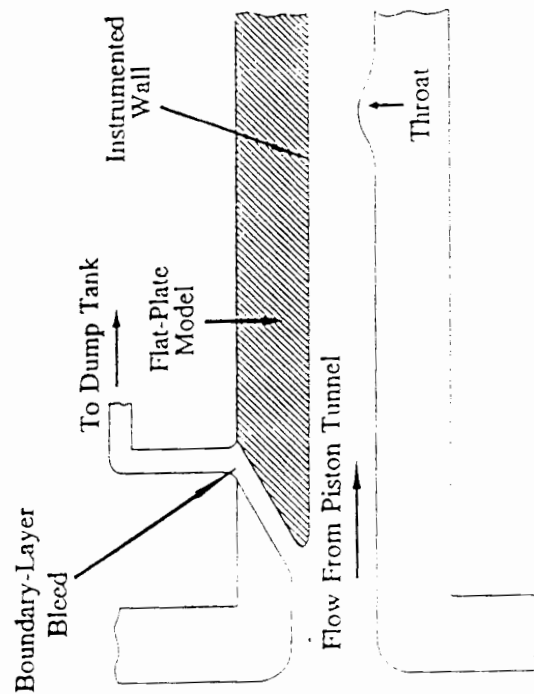
A series of experiments are described which examine the growth of turbulent spots on a flat plate at Reynolds and Mach numbers typical of gas-turbine blading. A short-duration piston tunnel is employed and rapid-response miniature surface-heat-transfer gauges are used to assess the state of the boundary layer. The leading- and trailing-edge velocities of spots are reported for different external pressure gradients and Mach numbers. Also, the lateral spreading angle is determined from the heat-transfer signals which demonstrate dramatically the reduction in spot growth associated with favourable pressure gradients. An associated experiment on the development of turbulent wedges is also reported where liquid-crystal heat-transfer techniques are employed in low-speed wind tunnel to visualise and measure the wedge characteristics. Finally, both liquid crystal techniques and hot-film measurements from flight tests at Mach number of 0.6 are presented.

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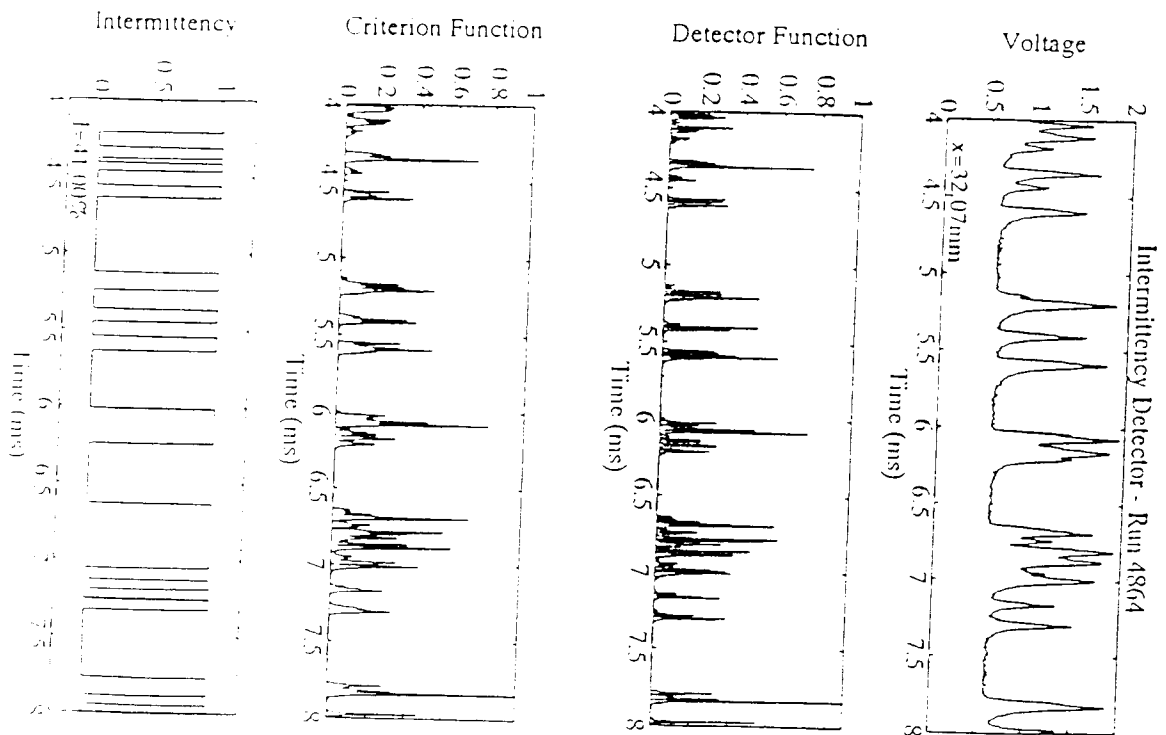
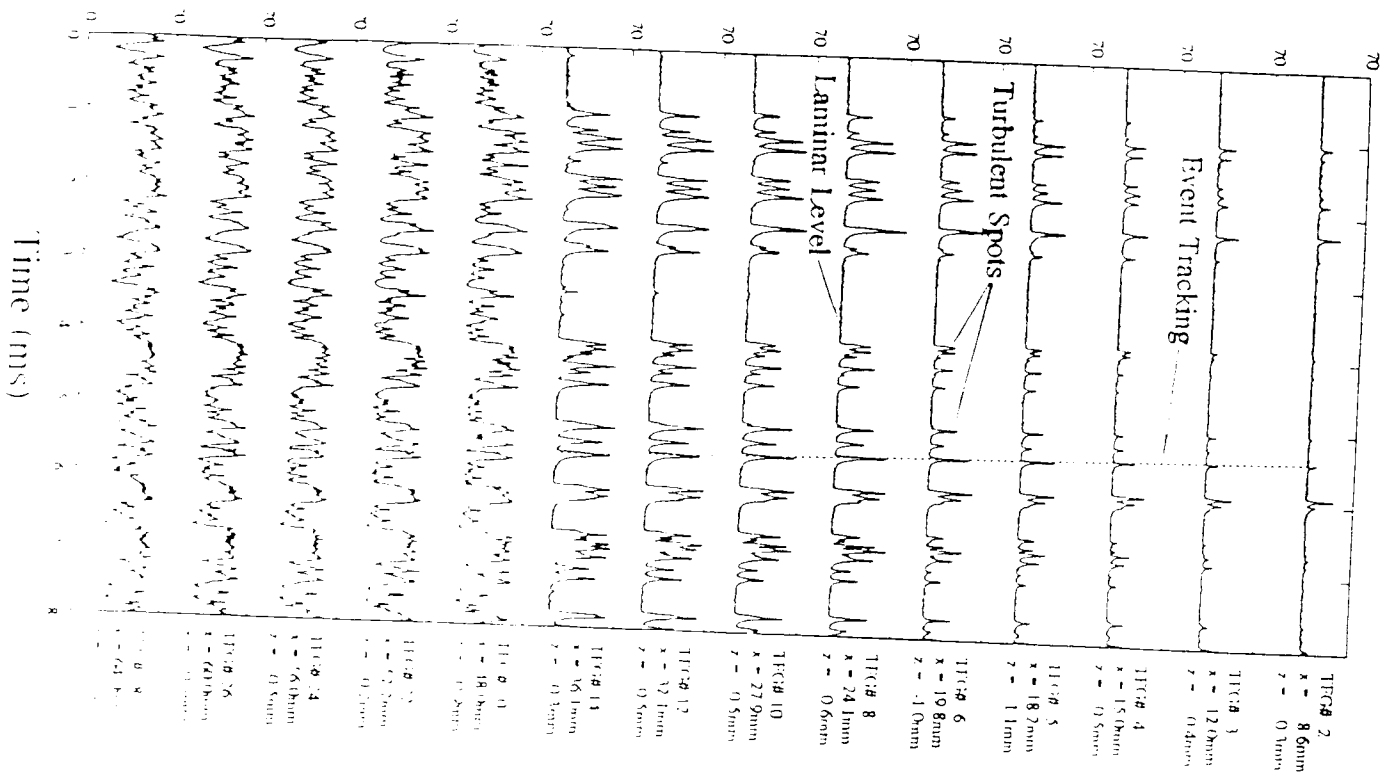
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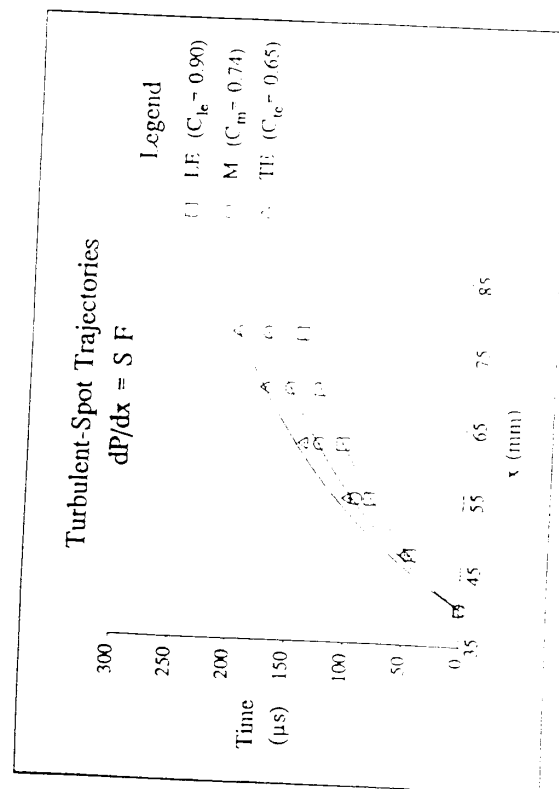
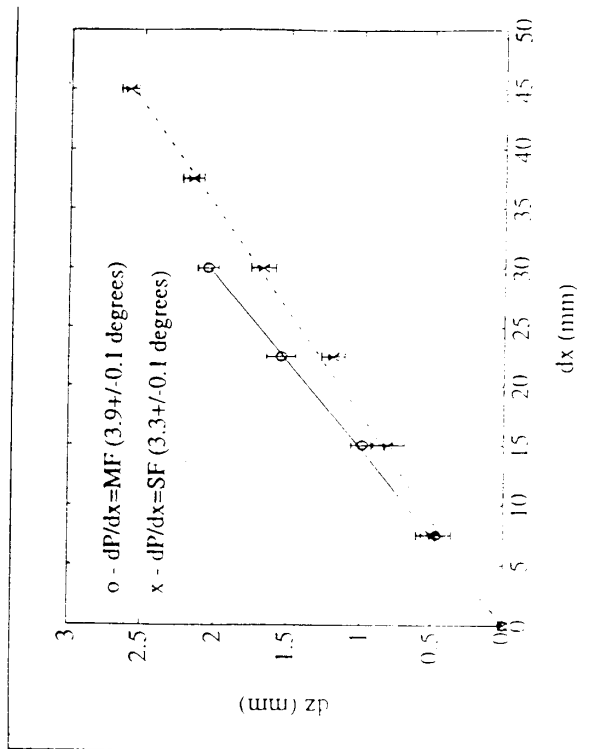
J.E. LaGraff, Syracuse University.

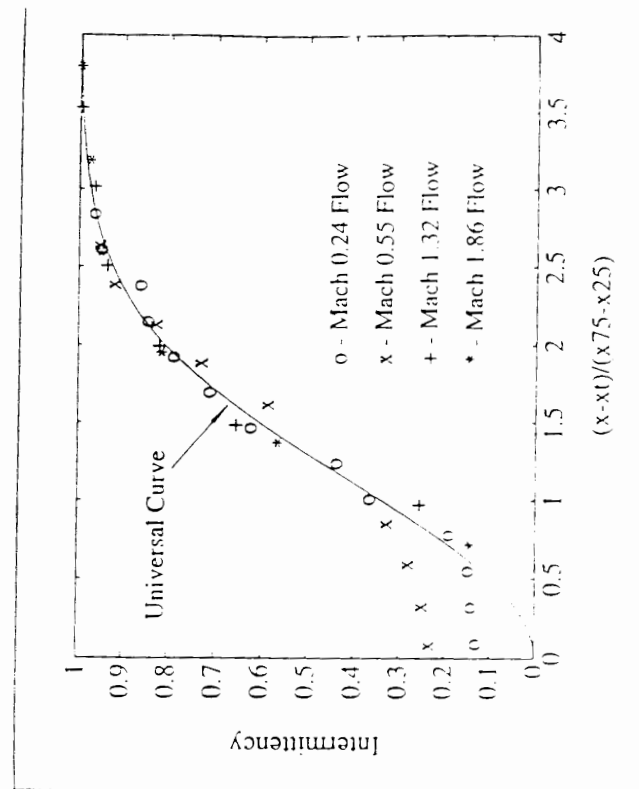
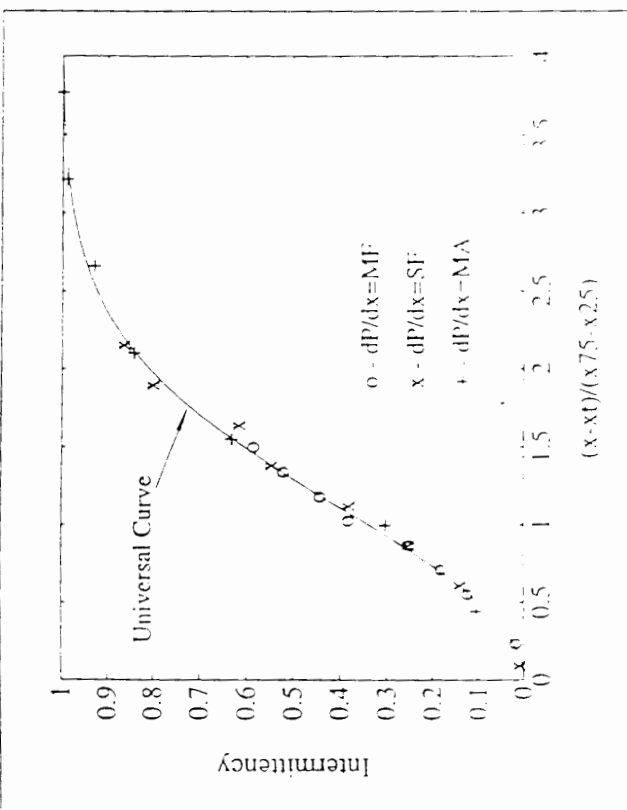
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\dot{q} (kW/m²)

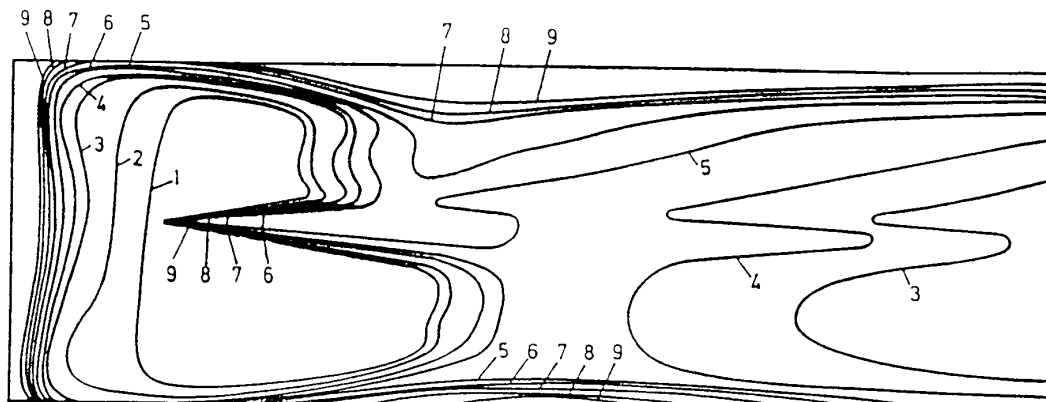
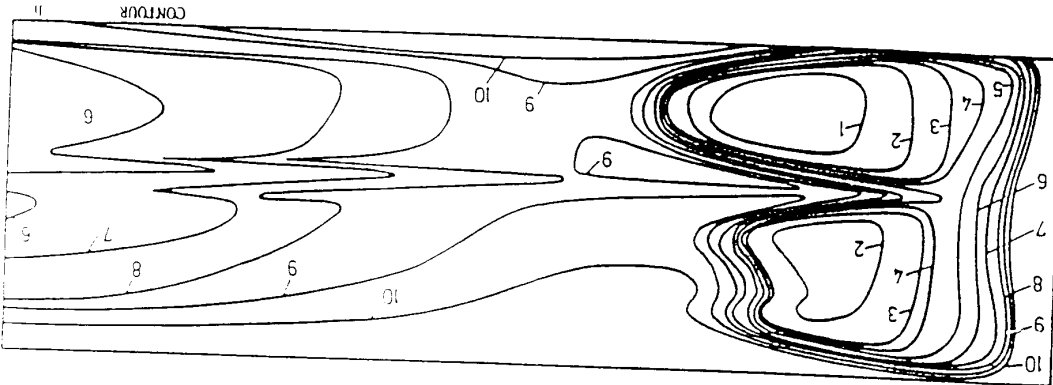






1	59.9
2	66.9
3	81.1
4	84.9
5	95.5
6	105.8
7	117.9
8	122.1
9	131.2
10	147.3

W/m²



CONTOUR	h W/m ² K
1	74.4
2	92.9
3	114.3
4	125.2
5	136.9

